ASSESSMENT OF HEAVY METALS IN TYMPANOTONUS FUSCATA VAR. RADULA FROM FORCADOS RIVER, BURUTU, AN OIL PRODUCING AREA OF DELTA STATE, NIGERIA

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Abstract
This study investigated the presence of heavy metals in periwinkle *(Tympanotonus fustcata Var. Radula (L)) from the Forcados River in the Burutu Local Government Area of Delta State, Nigeria.* 20g of periwinkle samples were collected from fishermen in the river, dried, crushed to powdered form and analyzed using an Atomic Absorption Spectrometric technique (AAS-Model Varian SpectrAA 220 Fast Sequential). The result showed high concentrations of heavy metals ranging from 3.5-5.0 mg/l (copper), 7.0-40.0 mg/l (zinc), and 5.6-10.0 mg/l (iron), 0.5-2.0 mg/l (cadmium), 0.5-1.0 mg/l, (chromium) and 0.3-5.0 mg/l (lead). The concentration of heavy metals result is represented in the order: chromium = lead< cadmium < zinc < iron < copper. The results show that the concentration of zinc, iron and copper are well above the FAO/WHO permissible limits. The concentrations of cadmium, chromium and lead were discovered to be below the FAO/WHO acceptable limits. This is an indication that continuous consumption of periwinkle from the Forcados river is expected to cause health issues related to heavy metals.

Keywords: Periwinkle, Forcados River, Heavy metals, Petroleum effluents, Oil producing area

INTRODUCTION

Human activities as a result of industrialization and urbanization have led to an increase in environmental pollution (Lindqvist & Block, 1995). The concentration of metals in the biota of an aquatic ecology is usually low except for areas prone to high metal pollution (Moslen, et al., 2017). The pollution of the aquatic ecology can be attributed to the disposal of metals and its components, solid waste, and metal leaching into surface waters (Obasi, et al., 2015). Periwinkle is an edible sea food scientifically known as *Littorina littorea*. Its shell is much harder and stronger than that of an ordinary snail. *Littorina Littorea* popularly called periwinkle are small, have dark shells and are found in Asia, Africa and Nigeria in particular (Ehi-Eromosele & Okiei, 2012). This aquatic organism has the ability to bioaccumulate and biomagnify aquatic pollutants emanating due to industrialization and urbanization without necessarily causing harm to itself (Lee, et al., 2002; Duruibe, et al., 2007; Evanko & Dzombak, 2007; Athar & Vohora, 2011; Moslen, et al., 2017). Salomons & Forstner (1995) posited that the associated pollutants due to industrial and domestic wastes are heavy metals grouped as essentially and non-essential pollutants. These heavy metal pollutants are elements such as nickel (NI), Arsenic (As), cadmium (Cd), mercury (Hg), lead (Pb), chromium (Cr), copper (Cu), and zinc (Zn) which may only be needed in the body in very minute amounts and can however lead to human poisoning when it is excess (Singh, et al., 2014). Soleimani et al., (2018) defined these heavy metals as biologically occurring elements with high

atomic weights and density greater than the density of water. These heavy metals have been reported to have adverse effect on human health (Izah, et al., 2016). Researchers have reported that the following diseases are associated upon severe exposure to heavy metals; arsenic may cause cancer (skin, bladder, lungs, liver and kidney) (Mebrahtu, et al., 2006); may lead to developmental abnormalities of fetuses with children the most vulnerable, to neurotoxic effects (US-GAO, 2000); mercury affects the nervous system, alteration in functions of the brain and may lead to tremor, irritability, shyness, memory problems and hearing impairment, speech or vision (Garbarino, et al., 1995); cadmium may severely damage the lungs, kidney, respiratory irritation, testicular deterioration and a possibility for prostate cancer (Lepp, 2012; Jenning, et al., 2006); chromium may cause stomach tumors, anemia, irritations and damage sperm (Banfalvi, 2011; Wong, 2012); Iron may lead to a damaged DNA (Wong, 2012); and although manganese is essential for the body, Mangesh (2011) noted that severe exposure could result to a disease with its symptoms similar to Parkinson's. Ijeomah et al., (2015) reported that Niger Delta, being the home for several oil and gas installations and petroleum spill, there is the concern for environmental pollution as a result of oil producing activities. Consequently, due to the reliance of the surrounding communities such as Burutu, Oburu, Aboh, and Ogolagha on aquatic organisms such as periwinkles and fishes, it is imperative for this study to assess the presence of heavy metals in periwinkle obtained from the Forcados River in the Burutu Local Governenment Area of Delta State, Nigeria.

MATERIALS AND METHODS

Study Area.

The study area was the Forcados River, at the Latitude: 05º23'10'' N; Longitude: 05º19'15'' E, under the Burutu Local Government Area, Delta State, Nigeria. The Forcados River is a major river in the Niger Delta part of Southern Nigeria. The area is fresh water and mangrove swamp connecting the Gulf of Guinea and the Niger River.

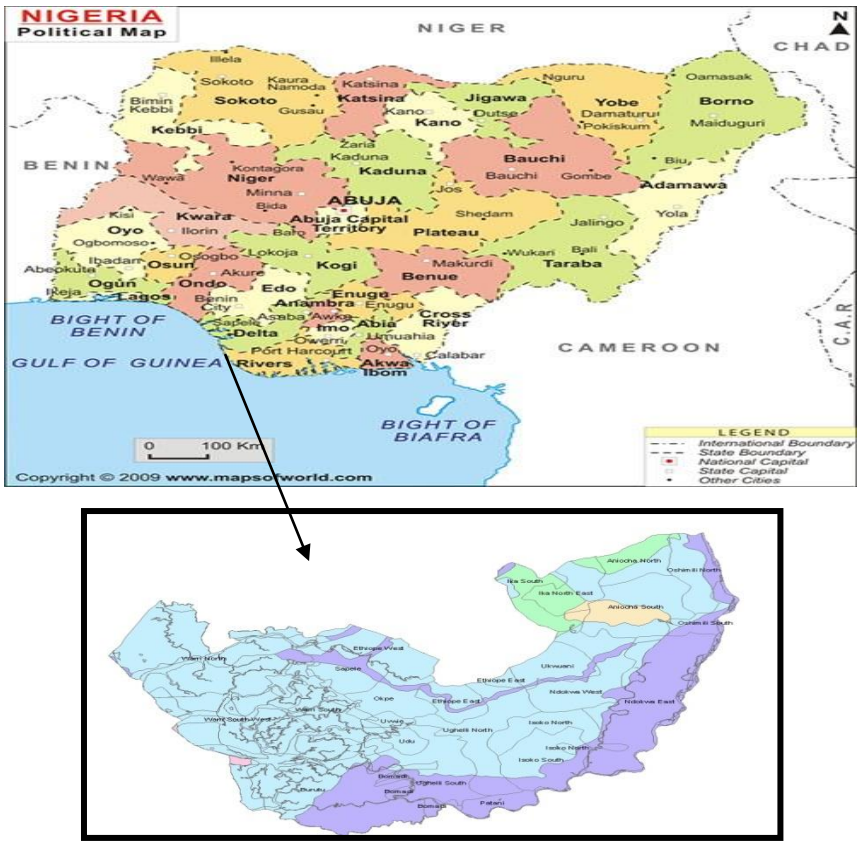

Figure 1: Administrative Map of Nigeria and Delta State showing the sampling location

Sample Collection and Preparation

20grams of fresh periwinkles of a particular specie were collected from fishermen operating in the Forcados River of Burutu Local Government Area of Delta State. The periwinkles were collected in an open bucket/container with their natural water, and transported to TUDAKA Laboratory, Warri, Delta State for laboratory evaluation. The samples were reserved in the fridge at 4^{o}C for proper analysis. The tissues of the periwinkle were removed from its shell with the help of a clean sterilized steel needle and then dried to a constant weight in the oven inside a clean petri dish. Once dried, the samples were reserved in a desiccator and allowed to cool. The samples were then crushed with a porcelain pestle and mortar into fine powder.

Methods of Analysis

Seven grammes of crushed samples were weighed and digested using the digestion method. In the approach of digestion, 10 ml of concentrated nitric acid (Analytical grade) was added to the samples. They were heated on a heating mantle at 150^{o}C for 30 minutes and filtered with 50 ml of deionized water. The filtrate was collected with a clean polyethylene container for laboratory analysis by atomic Absorption Spectrometic method (AAS-Model Varian SpectrAA 220 Fast Sequential). The collected samples were analyzed for heavy metals with the results then compared with the regulatory standard limit set for Food and Agriculture Organisation of the United Nations (FAO). The heavy metals of interest are lead, zinc, iron, copper, chromium and cadmium.

RESULT AND DISCUSSION

Heavy metals are largely regarded as very toxic to both animals and humans because of the harmful health consequences related with exposure to them even at low concentrations (Onwuka et al., 2000a; Onwuka et al., 2000b; Onwuka et al., 2001). The laboratory results for periwinkle samples are represented below in Table 1. Results observed from the periwinkle test showed the presence of heavy metals especially iron, copper, and zinc are at elevated level in comparison with standard limits (FAO/WHO). Table 1 and Figure 2 show that copper, zinc and iron had average values of 144.324 mg/l, 67.176 mg/land 142.549 mg/l respectively.

Table 1: Mean deviation of heavy metals concentration of periwinkles

Parameters mg/kg	Mean ± SD	FAO/WHO Limits
Copper	144.324±032	3.5–5.0
Chromium	<0.001±0.00	0.5–1.0
Zinc	67.313±0.12	7.0–40.0
Lead	<0.001±0.00	0.3–0.5
Iron	142.672±0.11	5.6–10.0
Cadmium	0.864±0.01	0.5–2.0

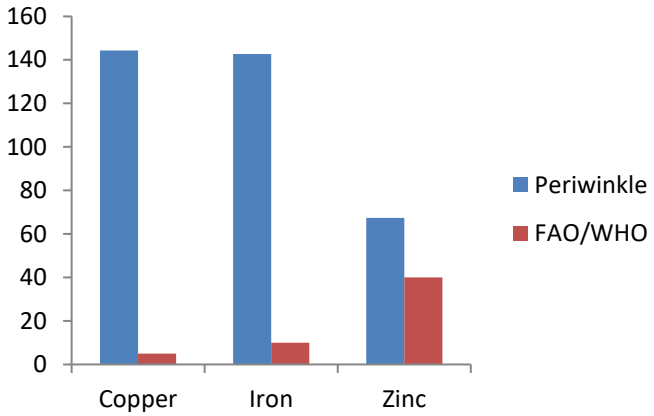

Figure 2: Copper, Iron and Zinc Concentrations in Periwinkles and the Standard Limit

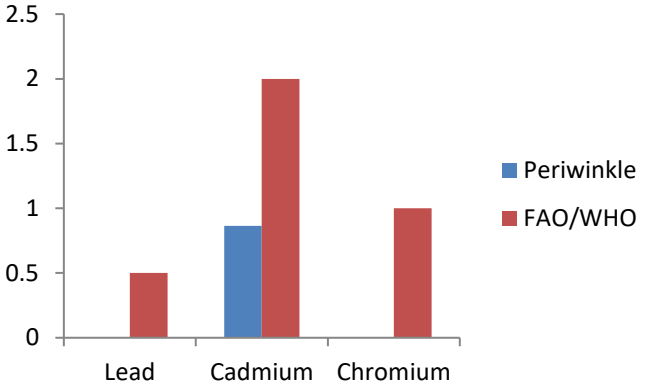

Figure 3: Heavy metals concentration in Lead, Cadmium and Chromium and Standard limits

Cadmium had an average value of 0.861 mg/l, while both chromium and lead had an average value of <0.001, as shown in Figure 3. The high concentration of heavy metals like zinc, iron and copper observed in the study samples are far above the permissible limits set by WHO, (2021) and FAO, (2003) for seafood, which are 3.5-5.0 mg/l for copper, 7.0-40.0 mg/l for zinc, and 5.6-10.0 mg/l for iron. While low concentrations of heavy metals like cadmium, chromium and lead are observed to be under the acceptable limits set by WHO, (2021) and FAO, (2003), which are 0.5-2.0mg/l for cadmium, 0.3-5.0 mg/l for lead and 0.5-1.0 mg/l for chromium. These values recorded may be due to an increase in the concentration of soluble salts and can also be attributed to the anthropogenic activities of oil installations and facilities around the river. Some of these oil companies in the area discharge their wastes into the river, which bring an increased concentration in some heavy metals. Higher concentrations of iron, zinc and copper in the tissues of *Tympanotonus fuscatus* is consistent with the report of Ijeomah et al., (2015) who confirmed that the non-vertebrate fauna species such as *Tympanotonusfuscatus* have a high attraction for zinc, copper and iron intake.

CONCLUSION

The study examined the level of some metals in the tissues of periwinkles (*Tympanotonus fuscatus)* purchased from the Riverbank of Forcados River, Delta state, Nigeria. The study found that lead, chromium and cadmium concentrations were within the edible permissible limits for seafood. While the levels of copper, iron and zinc surpassed the World Health Organisation and FAO acceptable limits for seafood consumption. Generally, pollution in aquatic ecosystems which is majorly by anthropogenic activities is a threat to biota

species of the aquatic ecosystem. Excessive intake of these heavy metals in seafoods may constitute health riskes. Therefore, restraint should be applied in the intake of periwinkles (*Tympanotonus fuscatus)* from Forcados River.

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